

# MANAGEMENT OF LYMPHATIC FILARIASIS

## A MANUAL FOR CLINICIANS



## Vector Control Research Centre Pondicherry

06121



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## PREFACE

This manual is aimed to acquaint medical professionals specifically those working in primary health centres on the “state of art” clinical management of filarial patients. Till date, treatment of filarial patients has been mostly empirical and the outcomes vary greatly. In the first few pages, the manual describes the current knowledge on the natural history of infection and the etiopathogenesis of the disease. Following this, different manifestations, together with their current management principles are described. Suitable photographs have been included to illustrate the clinical or therapeutic points. The uncertainties or controversies that still surround the possible mechanisms of disease or the outcomes of some management procedures are also discussed, to initiate some dialogue among the researchers and clinicians. In attempting to put forth a comprehensive picture, we have also highlighted some treatment measures which still require careful clinical evaluation.

This is neither a manual for carrying out filariasis survey in communities nor for disease control at community level but for clinical management of individual patients for whom sickness means loss of work and income. We hope this manual will help clinicians to update themselves on management and also act as a starting point for discussion and deliberation leading to the development of definite stage specific management principles in the future.

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## 1. INTRODUCTION

Filariasis in man is caused by lymphatic dwelling nematode parasites. *Wuchereria bancrofti*, *Brugia malayi* and *B. timori*. The disease is an important public health problem in many parts of the world and the second most important cause for permanent disability. It has been estimated that about 7.44 million lymphoedema cases, 12.88 million hydrocele cases and 31.26 million parasite (microfilaria) carriers live in India alone. This covers about 44% of the world's filariasis burden. This disease has important social and economic impact on individuals, families, and communities. It has been shown that the frequency of acute episodic attacks of filariasis increase with disease chronicity with a mean number of 4.2 attacks/year and loss of work for about 30 days per year for a middle aged patient. Further, the productivity of lymphoedema patients is significantly lowered compared to healthy individuals. The current control strategies focus on transmission control either by chemotherapy or by vector control. The principles of management of cases of filariasis and community morbidity control have not received adequate attention.

## 2. NATURAL HISTORY OF DISEASE

The natural history of disease is not clearly understood. The possible course, that leads to disease as currently envisaged is described in brief so as to understand the rationale behind the principle of management of this disease.

### a) Asymptomatic parasite carriers:

In an endemic area, while everybody is exposed to infective bites of mosquitoes only some individuals get infected. While some of them recover (i.e. clear the parasites), in others, the parasites grow through different stages to mature into adult worms. The mature worms of both sexes lodge themselves in the lymphatics where they mate and produce large number of microfilariae (mF). These microfilariae appear in peripheral blood of infected persons during night except in of diurnal forms of parasites. Most of these mF carriers are asymptomatic. The period for which the person will be microfilaraemic depends on the fecundic life span (period for which the adult female produces mF) of the adult worm, which is about 5.4 years for *W. bancrofti* and 3.4 years for *B. malayi*.

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Though the mF carriers do not always present with overt clinical manifestations, lymphatic pathology in the form of dilatation, kinking, collateral formation, etc., are common. Therefore, the mF carriers are at high risk of developing disease.

#### b) Acute filarial disease:

Some infected persons whether microfilaraemic or not, may present with clinical manifestations. Depending on the clinical manifestations, the disease is described as acute, chronic or allergic in nature. Acute filarial disease includes,

- filarial fever,
- epididymo-orchitis,
- lymphangitis,
- adenolymphangitis (ADL) etc.

Acute disease is essentially an inflammatory condition involving lymphatics and lymph nodes (see plate 1.a., b. & c.) . It is best described as acute ADL, though, the affected local sites could be different. The clinical signs include *pain, tenderness, redness, local swelling, local warmth (sometimes local abscess)* and systemic manifestations such as *fever, nausea, vomiting* etc. ADL episodes occur irregularly, particularly in patients with pre-existing lymphoedema. Although it has been classically described that ADL attacks have a centrifugal (retrograde) spread from the node to periphery, in many patients it could be the centripetal (i.e. antigrade), starting from peripheral part and spreading to the node. The actual etiopathogenesis of these attacks is yet to be clearly understood. Several factors are believed to play a role in the causation of these ADL attacks which includes,

a. micro/macro trauma to the affected region)	}	Centripetal
b. secondary bacterial and (or) fungal infections	}	"
c. parasite factors, particularly fresh infections of	}	Centrifugal
release of toxins during liberation of microfilaria	}	"
by adult female worms.	}	
d. altered immunological response by human host and	}	"
e. hard physical work	}	"



PLATE 1. CLINICAL FEATURES OF ADL



PLATE 2. GRADES OF LYMPHOEDEMA





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### c) Hydrocele:

Hydrocele is the commonest manifestation of bancroftian filariasis in the male population. When the parasites are lodged in the testicular lymphatics, it results in accumulation of fluid in the tunica vaginalis testis causing hydrocele (see Plate 1 d.). A majority of these patients do not give any history of ADL attacks in their life time therefore, the progression seems to be a passive phenomenon.

### d) Lymphoedema :

Continued and prolonged presence of worms, particularly in the inguinal group of nodes results in chronic pathology of lymphatics culminating in lymphoedema. This commonly affects lower limbs, rarely upper limbs and genitals in both sexes (lymph scrotum, penis, vulva) and female breast. These patients suffer from repeated attacks of ADL. Progressive lymph stasis is believed to increase their susceptibility to bacterial infections. Episodes of ADL attacks continue with proliferation of lymphatics and increase in oedema volume which is replaced by fibrosis, resulting in the consolidation of oedema and fibrous tissue formation. Thereafter, the progression of the local pathology results in skin thickening, disfiguration, ulceration and nodule formation. The lymphoedema of the lower limb is classified into four grades (see Plates 2. a., b., c., & d.),

- |         |   |
|---------|---|
| Grade 1 | Early oedema completely reversible on elevation.  |
| Grade 2 | Oedema of the limb which is partially reversible on elevation of the limb without thickening of the skin. |
| Grade 3 | Irreversible oedema of the limb with skin thickening.   |
| Grade 4 | Irreversible oedema of the limb with papillary and nodular growth.  |

### e) Tropical pulmonary eosinophilia :

Some individuals with fertilized adult female worms produce allergic reactions directed against microfilaria, thereby clearing the released mF, but producing the clinical syndrome of Tropical Pulmonary Eosinophilia (TPE) without microfilaraemia (occult filariasis). This is usually detected in areas endemic for bancroftian filariasis. Males are more commonly affected. The commonest presentation is paroxysmal nocturnal cough with hyper-

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eosinophilia, raised ESR, radiologic findings of diffuse miliary lesions or increased broncho-vascular markings with very high titres of antifilarial antibodies particularly against mF. There is an impaired lung function in most cases. If untreated, TPE may progress to a condition of chronic pulmonary fibrosis.

**f) Other manifestations:**

There are many other clinical manifestations (see plates 6.a, b, c, d, & e.) being attributed to filariasis. These include chronic funiculitis, chyluria, lymph varix, nephritis, chylocele, chylous ascites, chylous diarrhoea, endomyocardial fibrosis, pericardial effusion and mono-arthritis (knee) etc. Except chronic funiculitis and chyluria, others are rarely seen. In chyluria, patients complain of passing milky white urine due to admixture of chyle in urine. Some patients also complain of associated frank haematuria. The condition is usually painless and may be intermittent. Loss of dietary lipids, proteins and vitamins can result in weight loss and emaciation. The condition is believed to result from blockage of the retroperitoneal lymph nodes below the cisterna chyli with consequent reflux and flow of intestinal lymph directly into renal lymphatics. Microfilaria may be detected in urine or blood in few cases.

### **3. IMMUNE RESPONSE TO INFECTION AND DISEASE:**

A striking feature of immunity in filarial infections is the long term balanced relationship between the host and the parasite which acts like a double edged sword as far as pathogenicity is concerned. Following infection, the surviving adult worms usually induce parasite specific tolerance which reduces the host reaction to the worm. High levels of anti-parasite IgE and IgG4 are produced which is generally accompanied by eosinophilia. This is due to the preferential stimulation of T-cells which produce IL-4 and IL-5 (Th-2 type). IL-4 is known to promote B cell class resulting in IgG4 and IgE production. This condition is mainly seen in asymptomatic microfilaraemics. The IgG4 acts as a "blocking antibody" and thereby reduces the inflammatory activity of IgE.

It is believed that the breakdown of this tolerance results in induction of pathology. This has been associated with Th-1 type response. The development of pathology is also associated with high level of IgE, IgG1 &



IgG2 and low IgG4. Elephantiasis may result from killing of late stage larval antigens by IgE mediated mechanisms or by a passive reaction of naturally dying adult worms, evoking IgG1 and IgG2 antibody response which mediate inflammatory reactions.

The patients with tropical pulmonary eosinophilia elicit a very high IgE response which is predominantly developed against microfilaria. In TPE., mF are not found since the immunological hyper-responsiveness removes this stage of the parasite from circulation.

### Immune profile in Filarial Infection and Disease

Nature of Immune response	mF carrier	lymphoedema	TPE
<b>Cellular Response</b>			
<b>Th-1 Response</b> (Pro-inflammatory response/hyper-responsive state)			
IL-2	low	low	low
Gamma(g)-IFN	low	high	low
GM-CSF	low	high	low
<b>Th-2 Response</b> (Anti-inflammatory response/hypo-responsive state)			
IL-4	high	low	high
IL-5	high	low	high
IL-10	high	low	low
<b>Humoral Response</b>			
IgG1	low	high	high
IgG2	low	high	high
IgG3	low	high	high
IgG4	high	low	high
IgE	high	high	high
Eosinophilia	high	high	high

### 4. MANAGEMENT OF FILARIASIS:

The management of filariasis depends on infection status, stage of the disease and its complications.

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## **a) Microfilaria carriers**

### **Diethylcarbamazine (DEC)**

Currently DEC is the drug of choice for treatment of mF carriers. Several regimens have been developed. However, we have given two regimens which are widely accepted and are in current use.

- 6 mg/kg of body weight per day in 3 divided doses for 12 days (standard regimen followed).
- 6 mg/kg of body weight in a single dose given at monthly interval for 12 months.

We recommend the regimen 2 of above i.e. monthly spaced dosage which gives better results.

### **Ivermectin**

- A single dose of Ivermectin\* 400 mcg/kg of body weight to be repeated at 3 monthly intervals for one year (4 doses a year).

### **Ivermectin and DEC**

- A single dosage of Ivermectin 200 mcg and DEC 6 mg / kg of body weight. This may be repeated after 6 months. OR
- A single dose of DEC 6 mg/kg and Albendazole 600 (for adults) is found to be effective. This may be repeated after one year, after a re-examination of blood.

\*Ivermectin is not marketed currently in India for human use.

### **Management of adverse reactions to antimicrofilarial drugs**

- The adverse reactions are due to release of pyrogenic antigens following the death of microfilaria. About 60 to 70% of carriers get these reactions and the severity is related to pre-therapy mF count.
- The specific reactions are fever, headache and myalgia. Local reactions such as inflammation of lymph nodes/lymphatics, nodule formation may rarely occur.



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- Non-specific reactions such as nausea, vomiting and giddiness are usually due to the consumption of these drugs in empty stomach.
  - The adverse reactions peak on 2nd day and persist for about 5 days. These are self limiting, reasonably tolerable and can be managed symptomatically using antipyretics, anti-inflammatory and antihistamines.

## **b) Acute filarial disease**

### **Management of acute cases**

Judicial use of appropriate antibiotics for controlling bacterial infection and symptomatic therapy for management of inflammatory reactions remain the hall mark of treating acute filarial disease.

- Injectable Penicillin G is the drug of choice. However, newer synthetic Penicillin analogues such as Amoxycillin can also be given. If allergic to Penicillin, Erythromycin or other macrolides can also be given.
- Paracetamol for fever and body pain; anti-histamines for allergic reactions should be given. Other non-steroidal anti-inflammatory drugs (NSAID) such as Diclofenac Sodium can also be used in management of inflammatory reactions.
- Other drugs for symptomatic therapy (for complaints of nausea and vomiting) may be given as per necessity.
- Immobilization and elevation of the affected limb will ameliorate the suffering due to acute attacks.
- DEC can cause severe inflammatory reactions in some patients with ADL. Therefore it is better to avoid DEC therapy during the acute episodes. This may be resumed 3-4 days after complete cessation of ADL attack after completion of antibiotics and anti-inflammatory drugs.
- Acute attacks involving male genitals (commonly referred as acute funiculo-epididymo-orchitis) requires scrotal support with I.G. dressing and avoidance of physical trauma such as cycling.
- In case of abscess formation, surgical drainage should be done with appropriate follow up.

### **Prevention of acute disease**

Successful management of chronic disease involves not only management of acute episodes but also prevention of the same. Initial

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meticulous workup of individual cases followed by detailed long term followup should be done, which is essential for the prevention of recurrence of acute attacks. Care should be taken in working out a detailed case history for every episode of ADL to identify the cause for same and advise should be given towards future elimination of the same. We have given hereunder some simple suggestions that can be followed for achieving the prevention of acute attacks.

- **Foot hygiene**

1. Cleaning feet with soap containing 2% glycerine
2. Regular application of white field ointment between the webs of toes (to prevent fungal infection and smoothen the skin).
3. Regular clipping of toe and finger nails (finger nails are also important, to prevent the patients from injuring the skin by scratching the affected limbs due to itching).
4. Prompt attention to all injuries of foot (including minor ones elsewhere in the body).

- **Other measures**

1. Remove/treat any other established foci of infection. (caries teeth, CSOM, etc.)
2. For patients who get frequent attacks of ADL, long acting Penicillin (Benzathaine Penicillin 12 lakhs IM once every 3 weeks after carrying out mandatory sensitivity skin test) or
3. Oral penicillin (Penicillin V 100,000 IU; 65 mg one tablet) can be given daily.

**c) Hydrocele**

Most hydroceles of small size may not require any treatment. In moderate to big hydrocele, the treatment of choice is surgical. There is a report of significant benefit (reduction in size) by monthly courses of DEC (10 mg/Kg of body weight/day for 3 weeks) for 6 months. However, the experience needs to be properly documented for further evaluation.

**d) Lymphoedema**

Management of lymphoedema involves prophylactic and therapeutic measures. Prevention of occurrence of episodic ADL attacks is the most



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important prophylactic measure as already described above. The therapeutic measures include the following.

### **Medical Management:**

#### **1) Physiotherapy:**

Physiotherapy is useful in early lymphoedema cases and includes the following:

#### **Pressure bandage:**

Crepe bandage, elasto-crepe stockings are commonly used (see plate 3a&b). Most often these are used inadequately and improperly. Care should be taken to educate the patients in proper use of these. The elasto-crepe stockings are better, for simplicity, but have to be tailor-made for individual patients.

#### **Manual massage:**

The principle is to mobilise the fluid from the affected part; milking it upwards through the cutaneous and subcutaneous lymphatic networks to the abdomen. Though the experience in filarial lymphoedema is limited, this has a potential for domiciliary management where the patients and relatives could be educated/trained for daily application of this therapy (see Plate 3.e). Details of the procedure for manual massage is given in Annexure I.

#### **Thermotherapy:**

Thermotherapy is of value both for the reduction of oedema and for associated pain. Wet heat therapy by immersing the affected limb in a bucket of warm water for about 10 to 15 minutes daily in the evenings when the size of the swelling is increased due to day's activity to facilitate circulation is recommended. After which, the patient could massage the limb and lie flat with foot end elevated. Apart from this, hot ovens (modified Chinese therapy) are also used and it has been reported to be useful in many cases.

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### **Pneumatic compression:**

Single and multi-cell jackets are available for pneumatic compression of affected parts either for intermittent low pressure or continuous higher pressure generated using appropriate electrically operated machines (see Plate 3.c). Usually, reduction occurs immediately after therapy. The results are not sustained in course of time especially in ambulatory patients. Elastic bandaging after compression as an adjunct is essential.

### **Interferential current therapy:**

Low frequency interferential current stimulation is given to the affected part of the body, by using two electrodes placed on the skin diametrically opposite with one having a fixed stimulation (4000 Hz) and the other variable (3850 to 4000 Hz). This creates an interferential beat frequency equivalent to the difference between the two through the tissue (see Plate 4.d). This therapy has been found useful for reduction of pain and oedema. This therapy has been tried on a limited scale and the results show a decrease in oedema particularly in Grade II and III cases.

## **2) Drugs**

Courses of 12 day DEC (as described for mF carriers) can be given every month for 12 months. Apart from this Coumarin, (200 mg tablets taken twice a day) has been reported to be useful in reducing filarial oedema in the long run. However, the Coumarin experience in filariasis needs further evaluation.

## **3) Surgical Management:**

Surgical management of lymphoedema should be attempted only in cases which do not respond to aggressive medical management or have impaired activities (particularly in cases with physical and occupational disability) or for social reasons. The surgical procedures include (a) lymphatic drainage and or (b) excisional surgery (see Plates 4 a, b. & c.).



**PLATE 3. PHYSIOTHERAPY FOR LYMPHOEDEMA**



PLATE 4. SURGICAL MANAGEMENT OF LYMPHOEDEMA





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## **Drainage procedures**

These include lymphangioplasty, omentoplasty, flaps, lymph-vein anastomosis, lymph-lymph anastomosis, lympho-nodo-venous (LNV) shunt anastomosis, etc. LNV shunt show immediate good response particularly in cases with moderate to high oedema (Grade III cases with oedema volume more than 2 litres and duration of about 5 years) resulting in rapid reduction in oedema volume (by about 40%). However, the gains cannot be sustained and in most cases the oedema volume gradually increased. Post-surgery ADL attacks were the most important cause for the failure of maintenance of viability of shunt. However, LNV shunt may have a role as a pre-excisional surgical procedure in filarial lymphoedema.

## **Excisional procedures:**

This surgery may be considered in cases who have gross physical deformity or occupational disability. Reliable, objective assessment of the excisional procedures for lymphoedema particularly for long term results are not available.

Our current judgement is that lymphoedema should be managed primarily by medical procedure and surgery should be advocated in selected cases as a last resort, although the long term value of such procedures is largely uncertain. Further, we believe that medical management can be undertaken at domiciliary level, PHC level or at referral level. Surgical procedure should be done at referral centres only. Whatever therapy is advocated for lymphoedema, it is important to follow the cases by objective limb circumference measurements at fixed points.

## **Prevention/prophylaxis for filariasis**

Individuals in endemic localities should take preventive measures against mosquito bites (bednet or mosquito proofing of the house). Diethylcarbamazine (DEC) 300 mg (given as single dose after dinner) per day for 2 days in every month has been reported to be prophylactic. This is recommended only for people from non-endemic areas visiting endemic regions

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## **5. INVESTIGATIONS FOR FILARIASIS**

### **a) Detection of parasites**

1. Thick blood smear by wet film or stained blood smear examination.
2. Membrane filtration,
3. Detection of adult worms by ultrasound and
4. Immuno diagnostics are some methods currently in use to detect parasites.

Of all the methods, the wet film examination can be easily done at the PHC level. For this, a sixty cubic millimetre thick blood smear is taken after 8 p.m. The wet smear can be examined directly under the microscope to see the microfilariae or can be dried overnight, deheamoglobinized the next day and viewed under the microscope after staining the slide with J.S.B. stain. This is the standard method adopted to detect microfilaraemia.

### **b) Investigations for Clinical assessment in filariasis.**

Long term successful management of lymphoedema requires the periodical documentation of the changes in the limb volume to enable frequent evaluation of the therapy which the patient is given. The following are some of the vital tools which can be used in clinical assessment during routine management of chronic filarial lymphoedema.

1. Measurement of the limb at fixed points
2. Volumetry using water displacement drum
3. Tissue Tonometry
4. Lymphoscintigraphy
5. Lymphangiography and
6. Ultrasound to detect adult worms in scrotal lymphatics

### **Measurement of the limbs using a measuring tape.**

The most reliable technique to document the changes in the volume of oedema, is circumference measurement (see Plate 5.a). Using a measuring tape, sequential measurements of circumference of the limbs are recorded on a chart designed for this purpose (see Annexure II a & b). The changes in the readings serve in guiding the management of lymphoedema.



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## **Volumetry**

In the water displacement method, a drum connected with a calibrated glass column ( tube) and fixed to the external surface of the drum can be designed and used (see Plate 5.b). Water is filled to one half level and the initial reading in the calibrated tube is recorded. The limb is immersed vertically in the drum. The rise in the level of water in the drum corresponds to the rise in water column level in the glass tube. This is recorded. Recording is made similarly for the other limb. The difference in the readings of both the limbs reflects oedema volume. This quantified oedema volume serves as a valuable tool in monitoring the management of lymphoedema.

## **Lymphoscintigraphy**

This involves injecting of radiolabelled albumin intra-dermally and visualising the extent of damage and rate of flow using a gamma camera. This technique has the same value as lymphangiography but is expensive, although relatively less invasive and safe.

## **Lymphangiography**

This is carried out by injecting radio opaque contrast to the lymphatics. This technique is an important tool to diagnose and assess the damage in the affected limb caused by filariasis. This helps us to quantify the damage by assessing the patency and viability of the lymphatics and the draining nodes. The Dye test is done by injecting Evans blue dye subcutaneously in the interdigital spaces of the affected limb. It gives the extent of damage of the lymphatics visually. This test/procedure is simple and can be done on outpatients but requires initial training and experience to carry out. However, due to the possibility of anaphylactic reactions, it should be done only in referral centres.

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## **Annexure - I**

### **PROCEDURE FOR MANUAL MASSAGE FOR FILARIAL LYMPHOEDEMA**

#### **Introduction**

Manual Massage is a technique where gentle pressure is applied on the skin to reduce the pain and oedema of the affected region. This technique is applied in the management of filarial lymphoedema to reduce the lymph stasis and promote lymph flow as described below.

#### **Principle**

Manual massage aims to reduce oedema of the limbs by promoting lymph circulation from periphery to the centre, draining the lymph using the lymphatics of the abdominal wall into the thoracic duct. Massage is usually started in the abdomen initially and slowly extended to the periphery of the limbs. This ensures the opening up of the lymphatics facilitating the free flow of lymph. The direction of the massage is from below upwards (periphery to the centre).

#### **Procedure**

For a patient to undergo massage therapy he/she should be referred by the physician after confirmation that the patient is fit to undergo the same. The patient should wear loose clothing at the time of massage therapy. The therapist should be positioned on the right side of the patient. The patient should lie relaxed in supine position with the limbs fully extended. The patient should breathe normally. The patient should be explained the aim of the therapy and the procedure. The steps of massage are detailed below (see figures 1-20).

#### **Steps in massage**

##### **Step 1-3**

Both the palms of the therapist should be placed one above the other on the left lower abdomen as shown in the figure 1. Uniform pressure should be applied



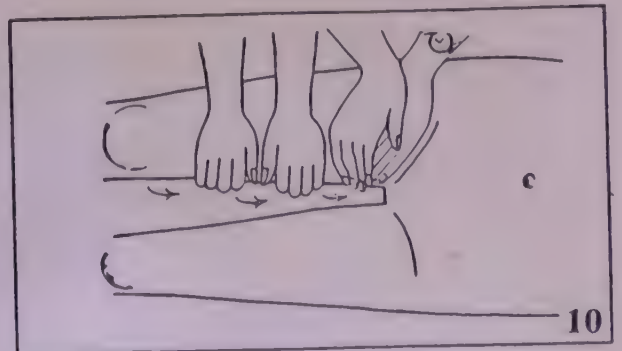
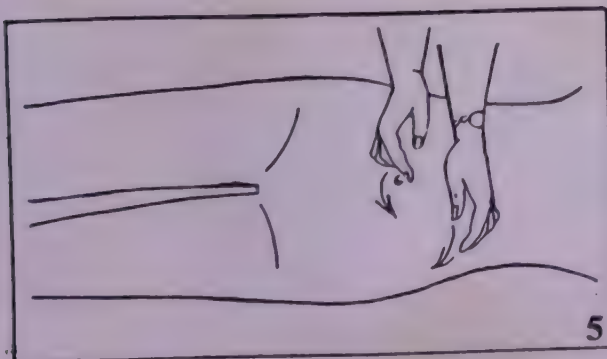
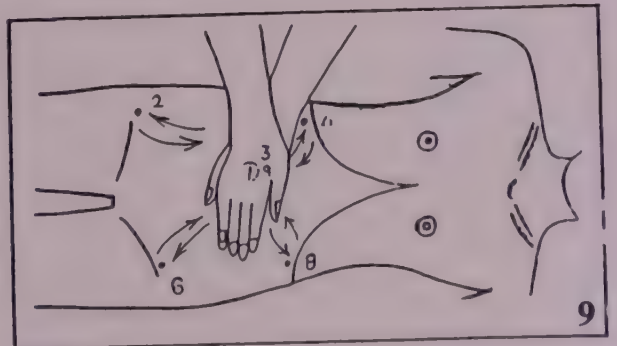
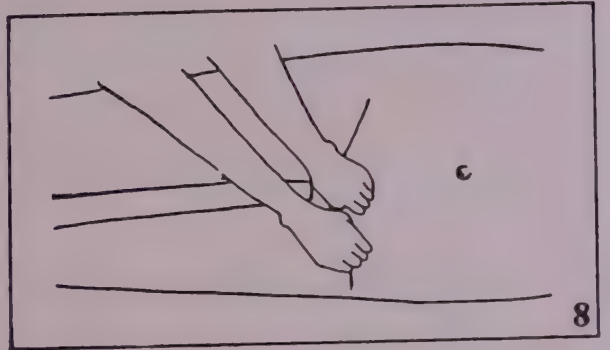
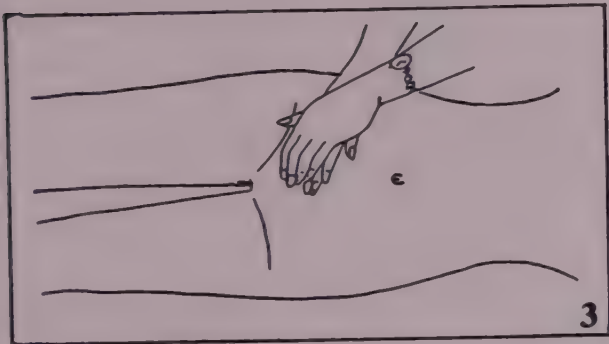
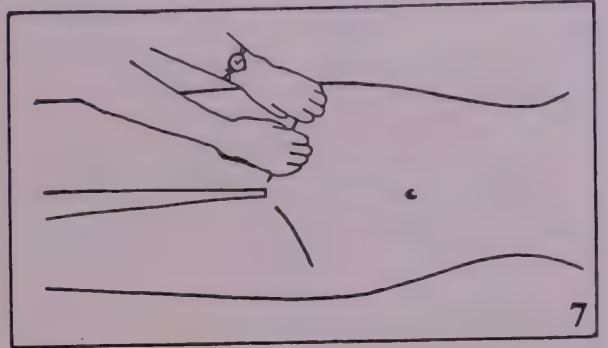
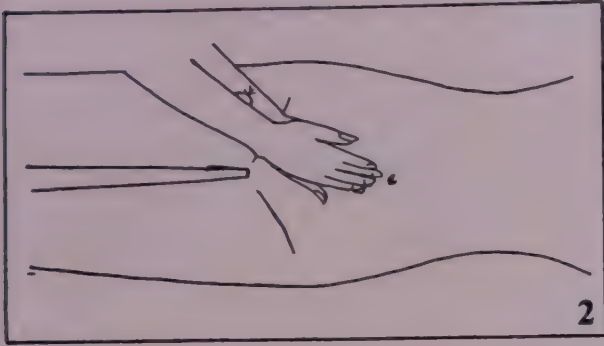
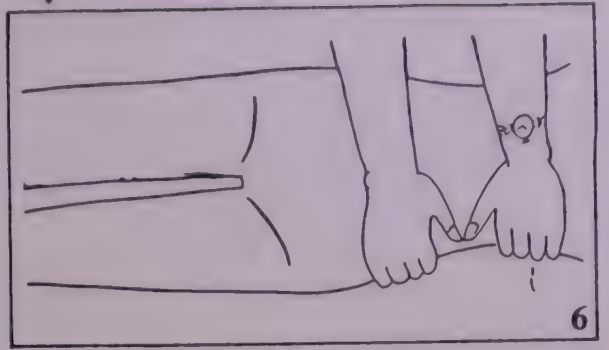
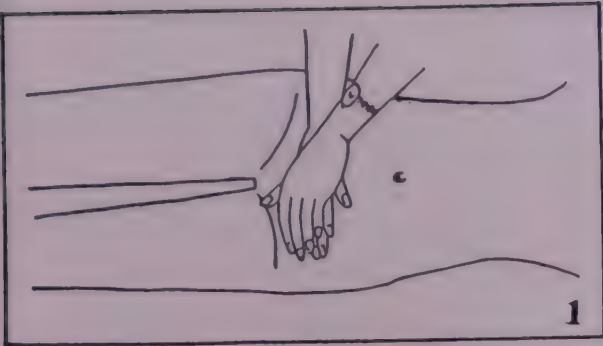
**PLATE 5. MEASUREMENT OF LYMPHOEDEMA VOLUME**



PLATE 6. OTHER MANIFESTATIONS OF FILARIASIS







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gently, directed downwards and medially. The similar procedure is done on the lower middle and lower right sides of the abdomen. (Fig 2 and 3).

#### Step 4

The palms are placed side by side on the right lateral abdomen and uniform gentle pressure is applied medially (Fig 4).

#### Step 5

In the upper abdomen the palms are placed alternatively from right to left and pressure is applied as shown in fig 5.

#### Step 6

The palms should be placed on the left lateral abdominal wall and application of gentle pressure is directed medially as shown in figure 6. (Repetition of step 4 from left side).

#### Step 7-8

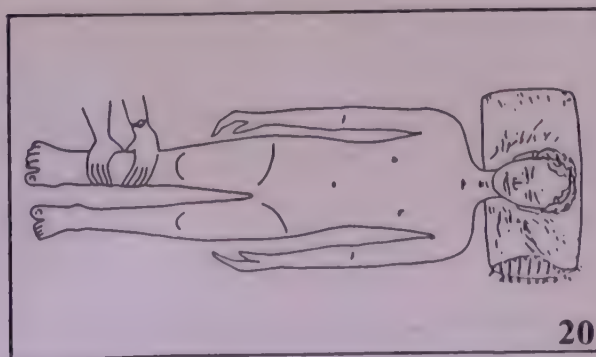
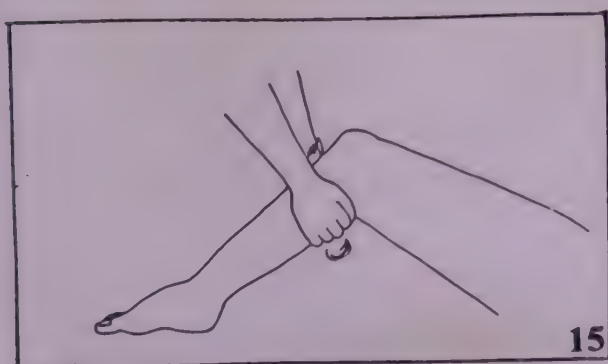
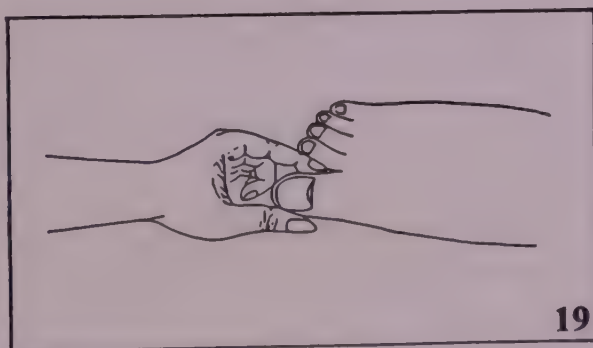
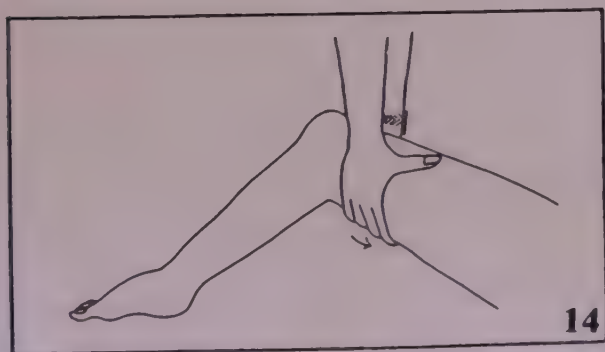
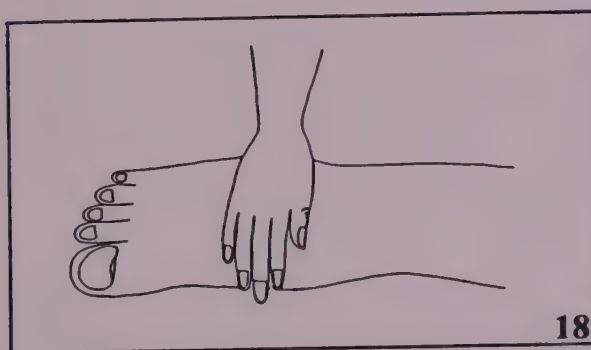
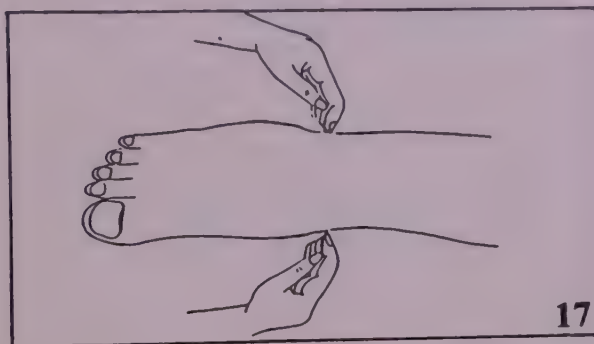
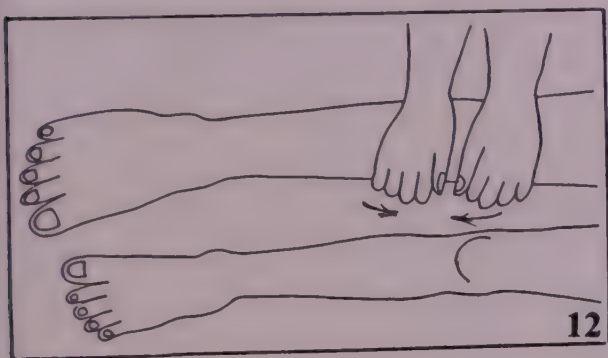
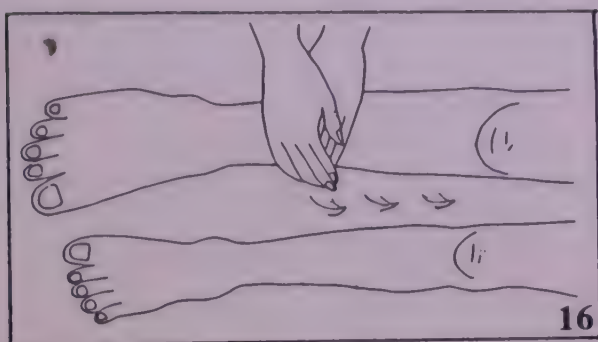
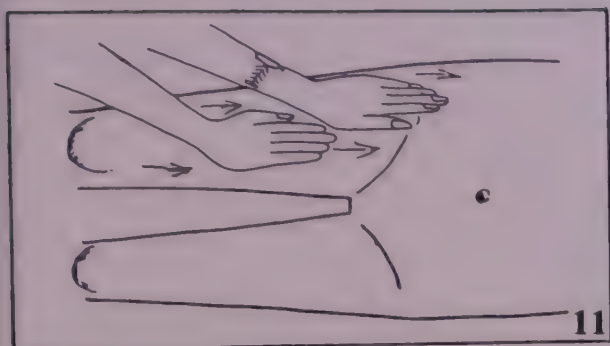
Both hands should be placed on the left lower abdomen (pelvic area), the hands should be placed straight and the finger tips should go deep in the abdominal wall with gentle pressure, with to and fro movements as shown in figure 7. This step should be repeated in the right lower abdomen also as shown in the figure 8.

#### Step 9

Both palms should be placed one above the other in the naval region as shown in figure 9. The patient should be advised to take deep and uniform inspiration and expiration.

Gentle pressure is applied with the hands during inhalation followed by a pause of few seconds and the patient is asked to exhale. This procedure is repeated in four quadrants with each time coming back to the navel area after massaging each quadrant following the order of numbers 1 to 9 in the abdomen shown in figure 9.





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### Step 10

The femoral pulse is felt in the femoral triangle and massage should be done avoiding the femoral artery area. Massage is initiated from the middle of the thigh avoiding the femoral triangle as shown in the figure 10. The palms are moved gently in semicircular fashion ending finally with hands cupped over the femoral triangle.

### Step 11

The palms are placed on the thigh and moved towards the abdomen with gentle pressure as shown in figure 11.

### Step 12

The palms should be placed on the medial side of the knee and gently massaged towards the medial aspect of the thigh (Figure 12).

### Step 13

The palms are placed on the lower part of the knee and is gently massaged upwards, moving from position 1 to 3 as shown in figure 13.

### Step 14

The palms are placed on the sides of the knee with the finger tips touches the popliteal area. The hands are moved gently and as it massages towards the thigh as shown in figure 14. The position of the leg of the patient and the hands of the therapist should be kept as shown in the above figure.

### Step 15

Following the popliteal area, massage is done by placing the hands on either sides of the thigh just above the knee and gentle pressure is applied from above downwards and this is repeated slowly towards upper parts of the thigh (figure 15).



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### Step 16

In the lower leg, the palms are placed one above the other and gentle pressure is applied from below upwards (figure 16).

### Step 17

The fingers of both the hands are placed just above the ankle joint and pressure is applied with the fingers in a semicircular fashion upwards for a few minutes.

### Step 18

Place palm of right hand on the dorsum of foot just below the ankle joint and move the palms gently upwards (figure 18).

### Step 19

Hold and toes (one after other) between the thumb and the index finger. Move the finger gently in semi-circular movement slowly upwards.

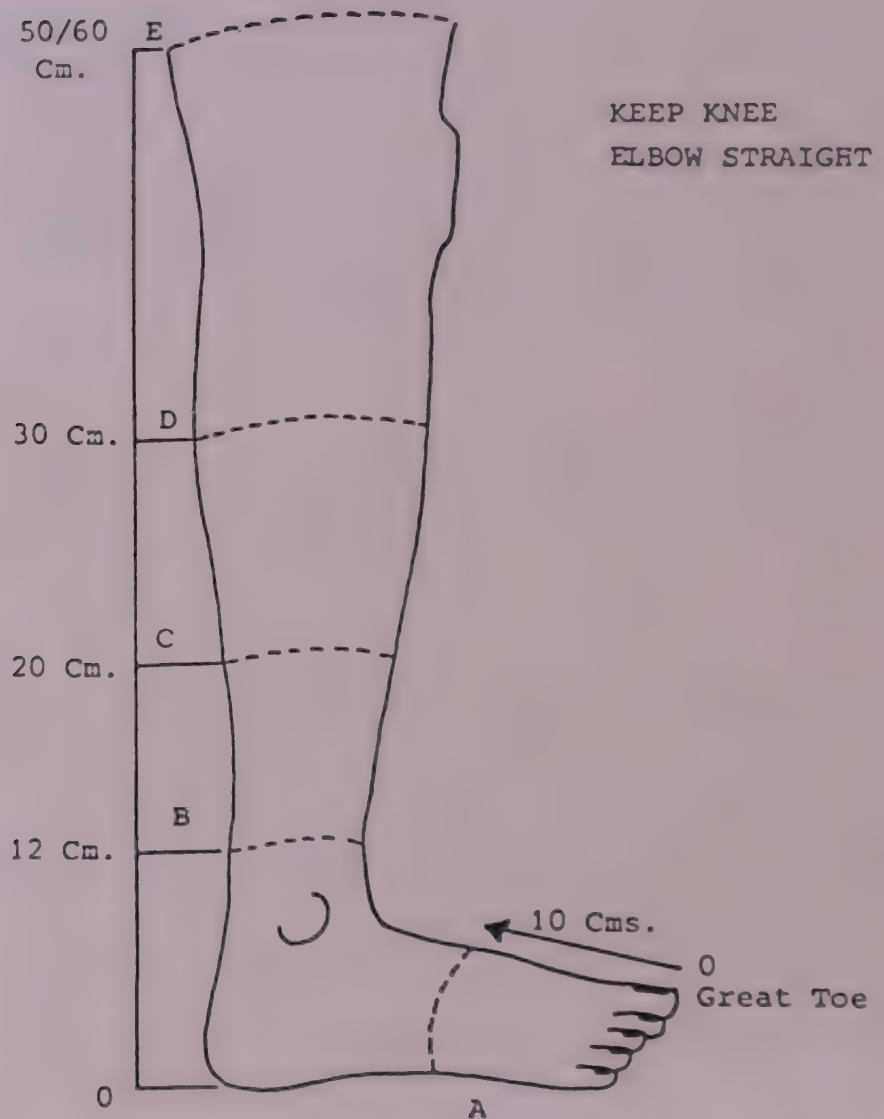
### Step 20

The massaging of the limb is done in an incremental manner involving the whole limb in later stages. Massage of the whole limb directed towards the trunk from the periphery. This is done for about ten minutes with each step being done for two or three times. It requires not only patience and motivation on the part of patient but also deft and application of gentle pressure by the therapist with full involvement. The massage therapy needs to be done daily.

## Annexure - II.a

### Measurement Points for Lymphoedema of Limbs

LL



A, B, C, D, E



**Annexure - II.b**

**Calculation of lymphoedema volume:**

**Measurements :**

Initial reading - I		Subsequent reading - S	
Normal Limb	Affected limb	Normal Limb	Affected limb
$A, B, C, D = X_0$	$A_1, B_1, C_1, D_1 = Y_0$	$A, B, C, D = X$	$A_1, B_1, C_1, D_1 = Y_T$

**Average measurements :**

Where,

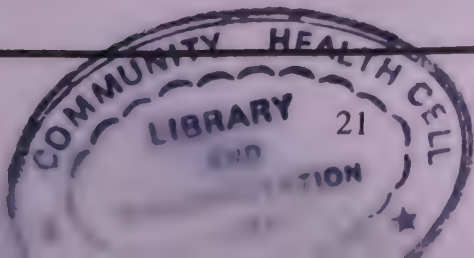
$$\begin{aligned} X_0 &= S(A+B+C+D)/4 \\ Y_0 &= S(A_1+B_1+C_1+D_1)/4 \\ X_T &= S(A, B, C, D)/4 \\ Y_T &= S(A_1, B_1, C_1, D_1)/4 \end{aligned}$$

**Difference between Normal and Affected limb:**

$$\begin{aligned} \text{Normal limb } (R_0) &= X_0 - Y_0 & \text{Affected limb } (R_T) &= Y_T - X_T \\ R_0 &= \text{Initial difference} & R_T &= \text{Final difference at subsequent reading} \end{aligned}$$

**Results:**

$$\% \text{ Response in individual case} = \frac{R_0 - R_T}{R_0} \times 100$$



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## **Details of Plates**

### **Plate 1:**

- a. Clinical features of ADL: Lymphangitis
- b. Clinical features of ADL: Inguinal adenitis
- c. Clinical features of ADL: Skin peeling during recovery
- d. Case of Hydrocele

### **Plate 2 :**

- a. Grade I lymphoedema
- b. Grade II lymphoedema
- c. Grade III lymphoedema
- d. Grade IV lymphoedema

### **Plate 3 :**

- a. Physiotherapy for lymphoedema: Pressure bandage
- b. Physiotherapy for lymphoedema: Elastocrepe stockings
- c. Physiotherapy for lymphoedema: Manual massage
- d. Physiotherapy for lymphoedema: Pneumatic compression
- e. Physiotherapy for lymphoedema: Interferential therapy

### **Plate 4:**

- a. Surgical management of lymphoedema: Pre - LNV shunt surgery
- b. Surgical management of lymphoedema: Post - LNV shunt surgery
- c. Post-excisional surgery after '4c' and '4d'

### **Plate 5 :**

- a. Measurement of lymphoedema volume: Circumference measurement at fixed points in the limb
- b. Measurement of lymphoedema volume: Water displacement by using a drum

### **Plate 6 :**

- a. Other manifestations of filariasis : Lymphoedema of breast
- b. Other manifestations of filariasis : Female external genitalia
- c. Other manifestations of filariasis : Lymphoedema of upper limb
- d. Other manifestations of filariasis: Lymphoedema of male external genitalia (lymph scrotum)
- e. Other manifestations of filariasis: Lymphoedema of male external genitalia (Ramhorn penis)



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